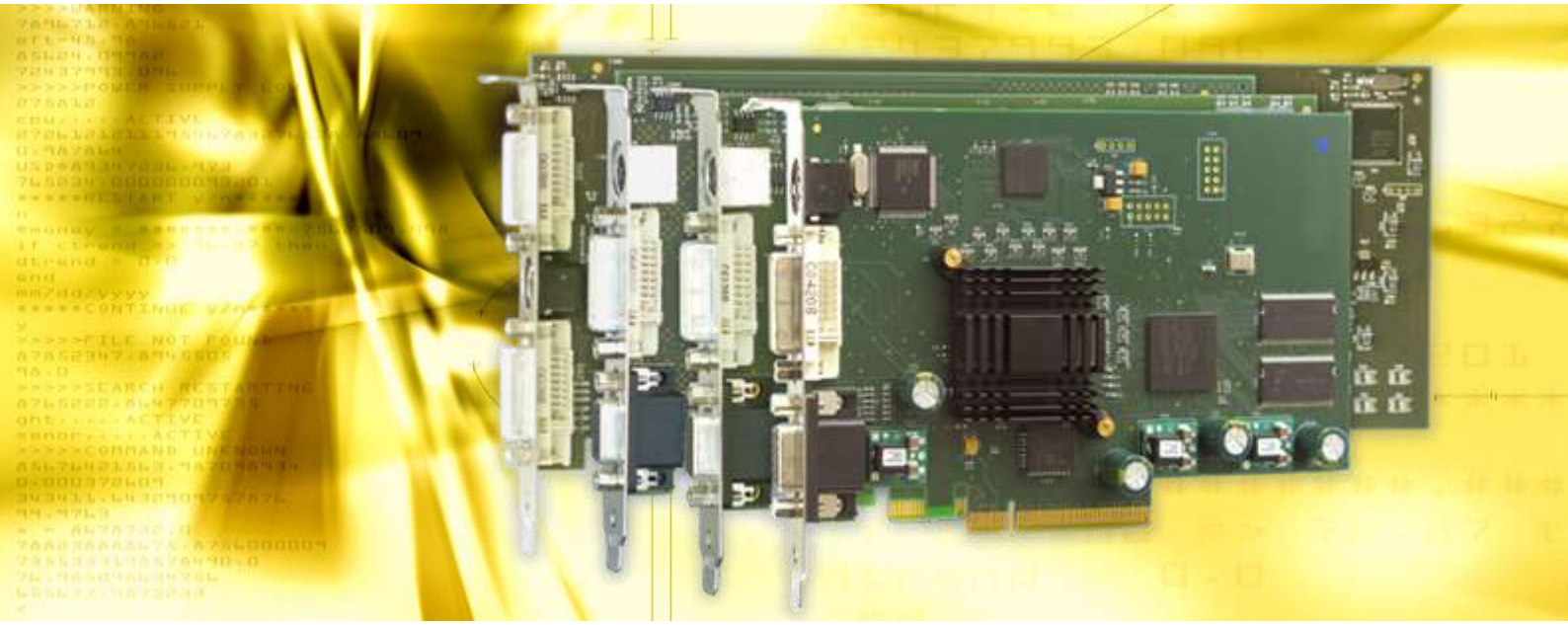
UFG-05 Family

Frame Grabbers



USER MANUAL

Windows® 7
Windows® XP
Windows® Vista

UNIGRAF

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CE Mark

The UFG-05 Family frame grabbers meet the essential health and safety requirements, is in conformity with and the CE marking has been applied according to the relevant EU Directives using the relevant section of the corresponding standards and other normative documents. Please find a Declaration of Conformity attached to this document.

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1. ABOUT THIS MANUAL

Purpose

This guide is the User Manual of UFG-05 Family of Frame Grabbers for use in a PC with Windows® XP Windows® Vista or Windows® 7 operating system.

The purpose of this guide is to

- Give an overview of the product and its features.
- Give instruction for the user on how to install the card.
- Give instructions for the user on how to install the related software drivers and libraries in a PC.
- Assist the user in configuring the capturing process with the user interface.
- Give instructions for the user how to capture images.

Product and Driver Version

This manual explains features found in product versions **UFG-05 4S, UFG-05 1E, UFG-05 32, UFG-05 Dual 32, UFG-05 Dual 64** and Windows driver version 2.2
Please consult Unigraf for differences or upgrades of previous versions.

Notes

On certain sections of the manual, when important information or notification is given, text is formatted as follows. Please read these notes carefully.

Note	This text is an important note

2. INTRODUCTION

Product Description

UFG-05 Family board are PCI and PCI Express Frame Grabbers capable to capture digital HDMI and DVI, analog RGB and Component Video and also S-Video or Composite Video. The input video performance of the three models is equal; they differ only in the PCI bus interface.

- UFG-05 4S; PCI Express 4 lane (mechanically 8 lane)
- UFG-05 1E; PCI Express 1 lane
- UFG-05 32; PCI (32 bit 66 MHz)
- UFG-05 Dual 32: PCI (32 bit 66 MHz)
- UFG-05 Dual 64: PCI-X (64 bit 66 MHz)

Product Features

- Captures video formats from 640 x 480 to 1920 x 1200
- Auto-detects VESA and CEA HDTV modes
- High capture frame rates achieved by efficient on-board data handling and high speed bus interfaces (pls. refer to product specification for details).
- Optional frame locking (capture 1/1, 1/2, 1/3 or 1/4 of original frame rate)
- In Dual models two fully independent capturing channels, both of which can be HDMI / DVI, RGB / Component or Composite video.
- 64 and 32 bit AVStream drivers (x64, WOW64, X86) that are compatible with DirectShow compatible applications like Media Encoder, VLC, and VirtualDub.
- Supports Microsoft® 7 (32 and 64 bit), Microsoft® XP (32 bit) and Microsoft® Vista (32 and 64 bit)

Identifying Connectors

The UFG-05 4S, UFG-05 1E and UFG-05 32 boards have three connectors on their front panel:

- S-Video connector for S-Video and Composite Video (top)
- DVI-I connector for digital HDMI and DVI input (middle)
- VGA connector (Sub-D 15) for analog RGB and Component Video (bottom)

The UFG-05 Dual 64 and UFG-05 Dual 32 boards have three connectors on their front panel:

- S-Video connector for two Composite Video inputs (middle)
- Two DVI-I connectors for digital HDMI and DVI input and analog RGB and Component input

3. INSTALLATION

Unpacking

The UFG-05 family frame grabber product shipment contains

- The UFG-05 card in an anti-static bag
- The Utilities CD containing drivers for Windows operating system along with Ready to use sample Windows applications. An electronic copy of this User Manual is included.

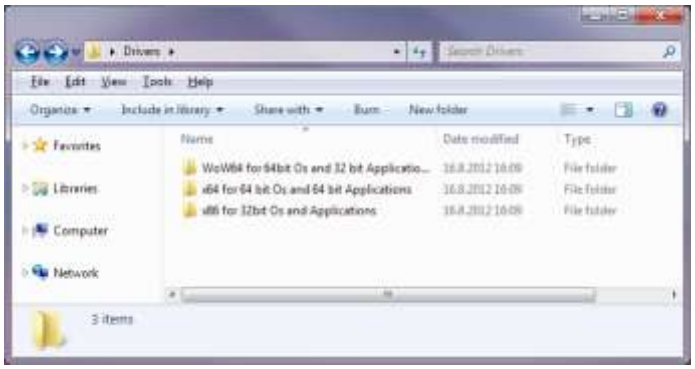
Note	The UFG-05 boards are highly dedicated electronic devices that contain ESD sensitive components. Before opening the anti-static bag and always before touching the card, please be sure to ground yourself. You can do the grounding by wearing a special grounding strap or simply touching a grounded metal surface.

Driver Type Selection

The UFG-05 family supports Microsoft® 7 (32 and 64 bit), Windows® XP (32 bit) and Windows® Vista (32 and 64 bit) operating systems. The Installation CD includes three alternative drivers:

- **WOW64** drivers *64 bit operating system and 32 bit applications*
- **x64** drivers for *64 bit operating system and 64 bit applications*
- **x86** drivers for *32 bit operating systems and applications*

The three drivers are located in separate folders in the installation CD. Please make sure that you select the proper one for your operating system and the application that you are using.



Driver Installation

- ▶ Power down your PC.
- ▶ Insert UFG-05 card in a vacant PCI slot in your PC.

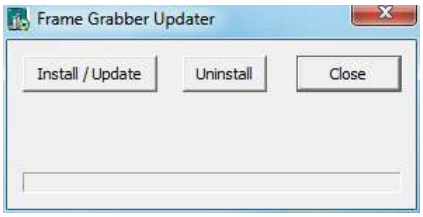
Note:	The hardware installation must be done before the software installation. Please use a PCI Rev 2.2 (66 MHz) slot for *UFG-05 32* or *UFG-05 Dual64*, PCI-X (66 MHz) for *UFG-05 Dual64*, PCI Express 1.0 for *UFG-05 1E* and PCI Express 2.0 for *UFG-05 4S*. You can use either a 3.3 V or a 5 V slot

- ▶ Boot the Windows XP system and log in

Note:	System administrator's privileges are required for performing the installation.

The Plug and Play subsystem will detect the newly installed UFG-05 family board.

- ▶ In the *Welcome to the New Hardware Wizard* click **Cancel**. Please use the *install.exe* routine for pre-installation before the actual Windows installation.
- ▶ Open the folder containing the requested driver type included in the UFG-05 family Installation CD.
- ▶ Run **install.exe** application.
- ▶ Select **Allow** whenever the operating system prompts for permission.

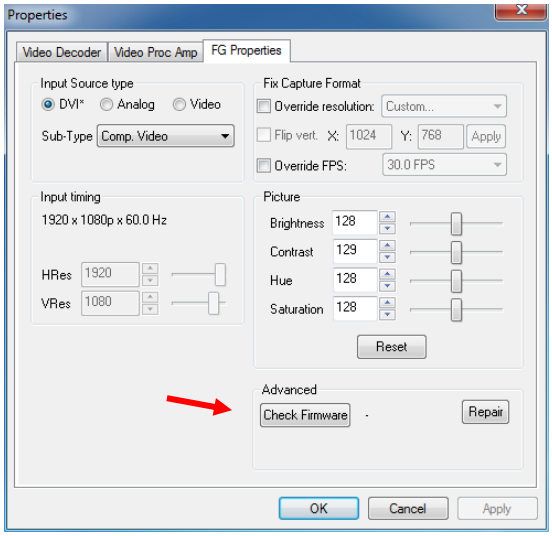


- ▶ Click **Install/Update**. Press **Continue** and **Apply** whenever the operating system prompts for permission.
- ▶ Click **Close** when the installation is completed. The UFG-05 driver is now ready for use.

Firmware Update

You can check the firmware version loaded into the non-volatile memory of the unit. The firmware version must match to the driver version used.

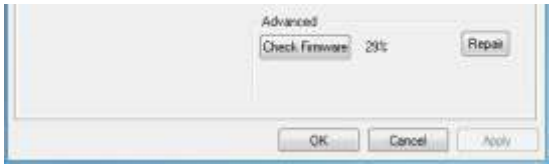
- Open the **Capture Filter Properties** dialog of e.g. AmCap tool. Select **FG Properties** tab.
- For verifying the firmware programmed on the UFG-05 unit please click **Check Firmware** in the *Advanced* section of the dialog.



- Open the FG Properties tab and click Check Firmware.
  If firmware is OK **Press No.**

- If firmware does not match to the driver press **Yes**.

  Please note that the firmware update will take about three minutes.



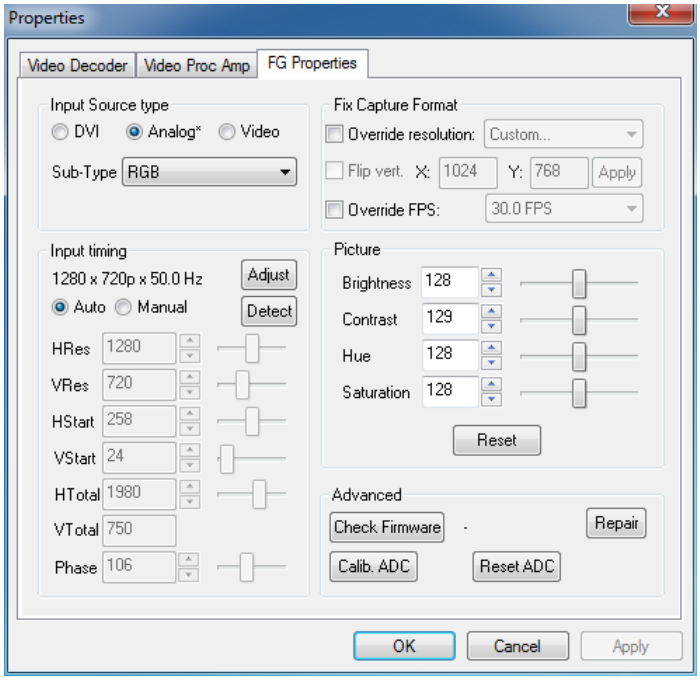
- After the update is completed please restart the PC.

4. CONFIGURATION

Configuration Dialog

The parameters that describe the input source can be configured by the **Capture Filter Properties** dialog. The dialog contains three tabs: Windows standard *Video Decoder* tab, a *Video Proc Amp* tab and the *FG Properties* tab. All capture properties for UFG-05 can be configured through the *FG Properties* tab.

The controls on the *FG Properties* panel are divided to five functionality sections. Please find below the description each section.



Input Source Type

You can select one of the three input types *Analog*, *Digital*, and *Video* with the radio buttons in the *Input Source Type* section. In addition to that within each input type you can define sub-types. For Analog and Digital you can select either RGB or YPbPr / YCbCr. For Video you can select the four combinations between S-Video and Composite and between PAL, NTSC and SECAM. The *Input Timing* section has a unique appearance for each of the three input types.

When switching between the input types the last valid values in the *Input Source Type* and *Input Timing* sections will be restored.

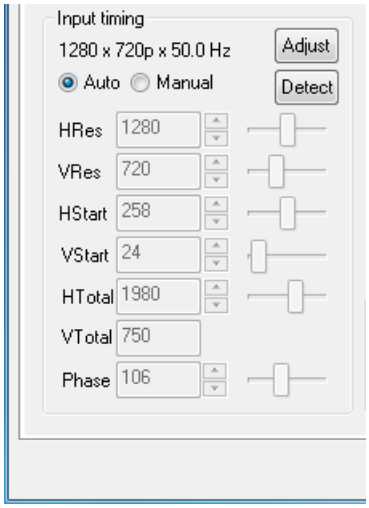
Analog Input

The *Input timing* section has a unique appearance for each input type. For *Analog* sources the section contains the full selection of controls for adjusting the position of the captured image in the video signal.

On the top of the section you can see the detected timing mode. E.g. 1080p indicates a progressive timing and 1080i an interlaced timing. For interlaced timings the field frequency is indicated.

You can select between automatic and manual timing adjustment by selecting either the **Auto** or the **Manual** radio button.

Automatic Detection



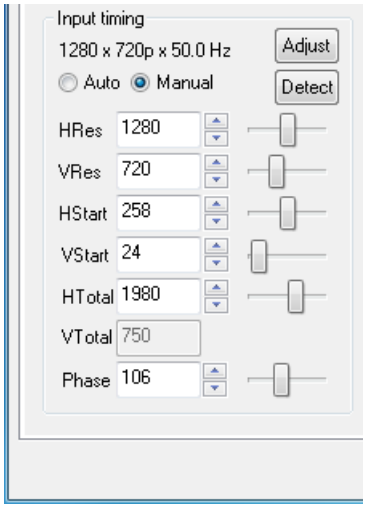
You can start the full automatic timing detection by clicking the **Detect** button. The full detection measures the horizontal and vertical frequencies to find the matching timing and in the end finds the positioning of the image.

You can perform only the positioning of the image based on the picture data by clicking the **Adjust** button. The positioning adjusts the image boundaries and the horizontal total and pixel frequency values. It also adjusts the sampling phase.

The positioning is based on the captured image. For the best result please consider the following rules:

- Please use a short and high quality video cable.
- Please use a still image during adjustment (no moving, flickering, etc.)
- Please use an image with light edges.
- Please use an image with sharp vertical edges e.g. black text over white background
- A spread sheet tool or a word processor program maximized to full screen will provide a good image for positioning

Manual Timing Adjustment



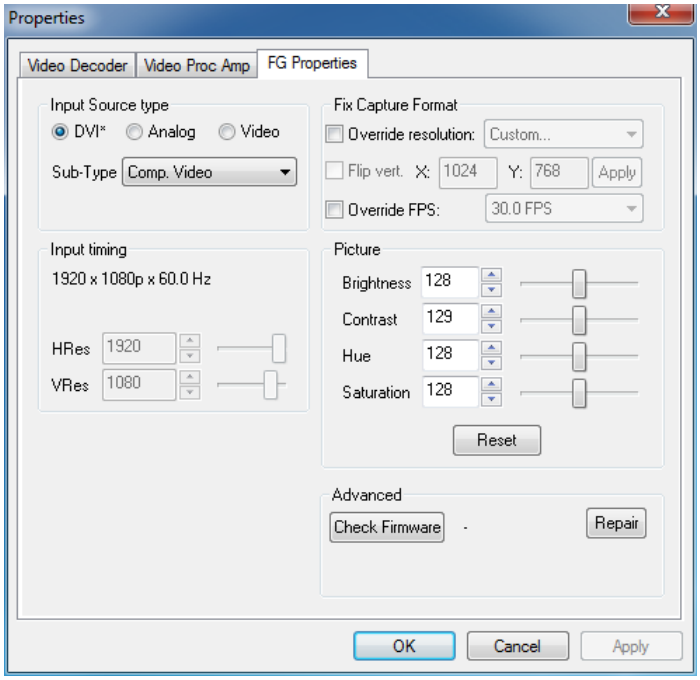
For manual timing adjustments, please fill in the corresponding fields. In the *Automatic Detection* mode they are filled by the driver.

HRes	Horizontal size of the captured bitmap,
VRes	Vertical size of the captured bitmap
HStart	Horizontal start (horizontal sync + horizontal back porch
VStart	Vertical start (vertical sync + vertical back porch)
HTotal	Horizontal total
VTotal	Vertical total
Phase	Adjust the A/D conversion sampling phase to align with the centre of the pixel of the incoming video

Please click the **Apply** button after updating the fields.

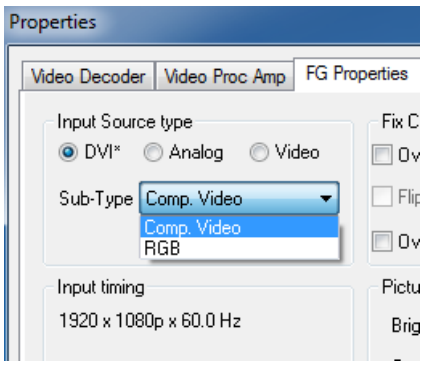
Digital Input

For *Digital* sources the *Input Timing* section contains only two automatically updated fields. Digital sources are set up automatically and they do not need any detection or calibration procedure.



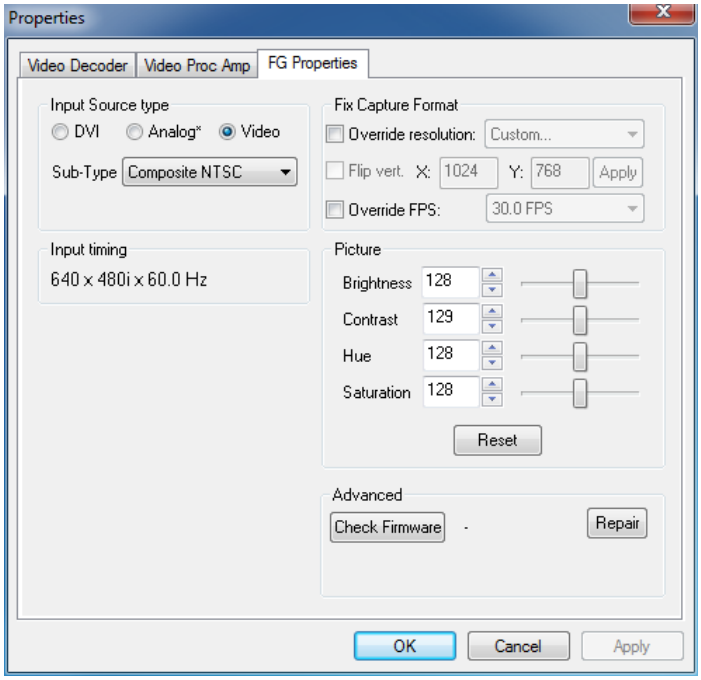
HRes horizontal size of the captured bitmap**,**
VRes vertical size of the captured bitmap**.**

Both for Analog and Digital inputs you can select the color mode as a Sub-type. The alternatives are *RGB* and *Comp. Video* (YPbPr / YCbCr)

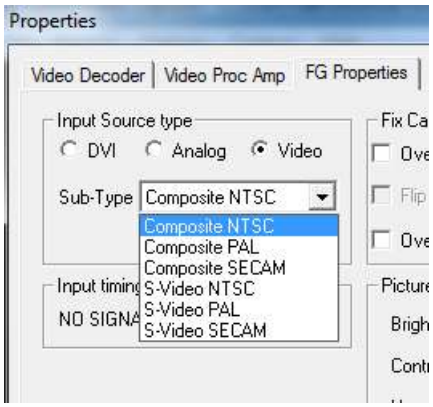


S-Video and Composite Video

S-Video and Composite Video sources are input through the S-Video Line-In jack in the rear panel of the frame grabber board.



On the *Sub-Type* selection you can select between the input type and the video type. The selections are: *Composite NTSC, Composite PAL, Composite SECAM, S-Video NTSC, S-Video PAL and S-Video SECAM.*



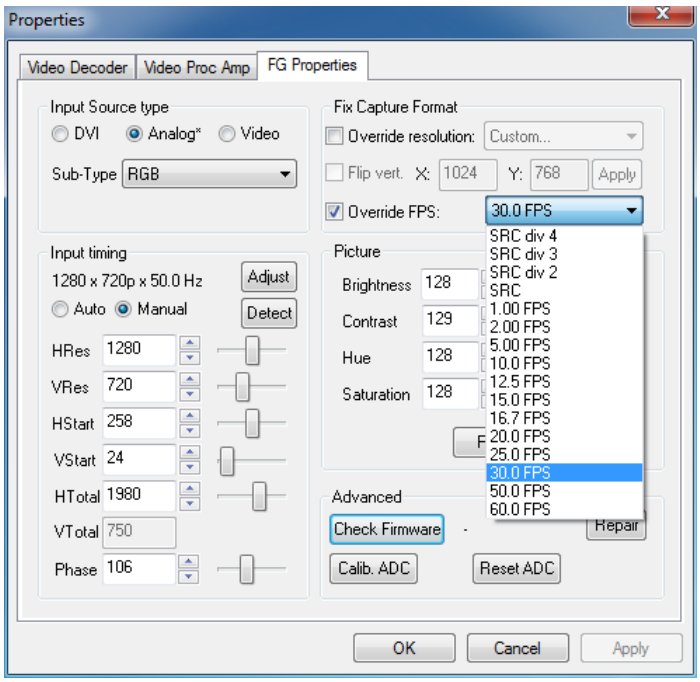
The *Input Timing* section shows the detected source timing. Please note that this is NOT the selection that the user did in the *Sub-Type* above.

Overriding Capture Format

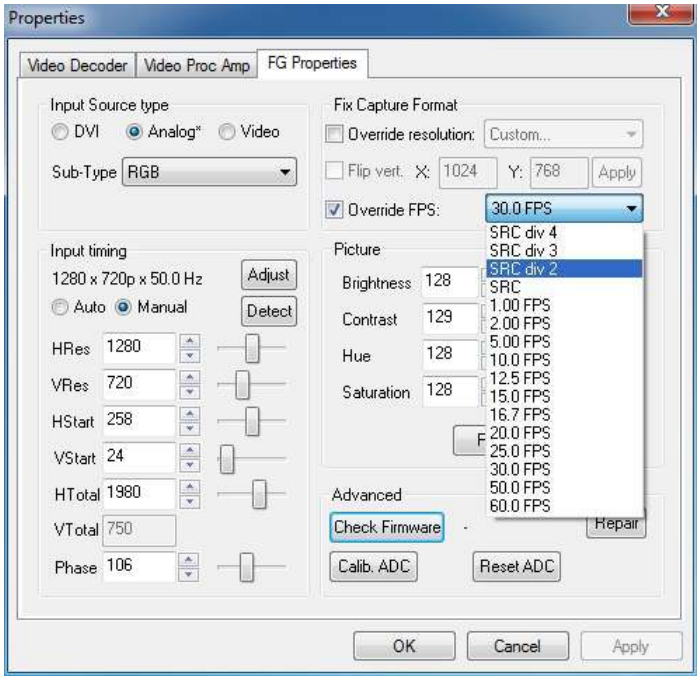
The *Fix Capture Format* section is used for overriding the source capture frame size and frame rate. You can do this by configuring the UFG-05 hardware to scale the captured image or by selecting only a pre-defined portion of the incoming frames for output. The reason for doing this is to optimize the performance of the card by limiting the amount of data transferred to the PC.

- You can have the UFG-05 HW downscale the captured image for saving the PCI bus bandwidth and PC resources.
- You can frame lock to every 2nd, 3rd or 4th frame of the original video input to save PCI bus bandwidth and ensure a smooth video stream output.
- You can limit the captured frame rate to an arbitrary fps value
- You can control the image orientation when stored in the PC

You can enable the hardware scaling by selecting the **Override Resolution** check-box and select the new frame size either from the combo-box. Please use the *Width* and *Height* fields below for custom formats. Please use **Apply** button to save the custom values. The dimensions selected will be forced for the capture pin even if the host application requests another format.



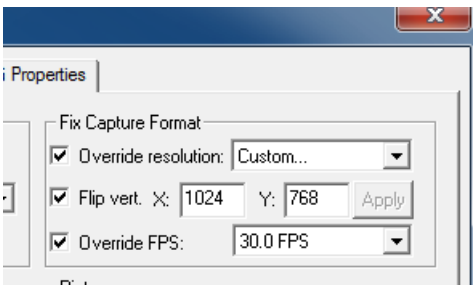
You can make the UFG-05 to override the frame rate request of the application by selecting the **Override FPS** check-box. The hardware will use the selection in the combo-box on the right. The first four settings are used for *Frame Locking*. This means that the UFG-05 returns all frames (SRC), every 2nd frame (SRC/2), every 3rd frame (SRC/3), every 4th frame (SRC/4) of the input source. These settings result the best video quality for displaying and capturing especially for high frame rates.



Note	Frame Locking is designed to operate for progressive and interlaced sources with 60 Hz and 50 Hz vertical frequencies and field frequencies respectively.

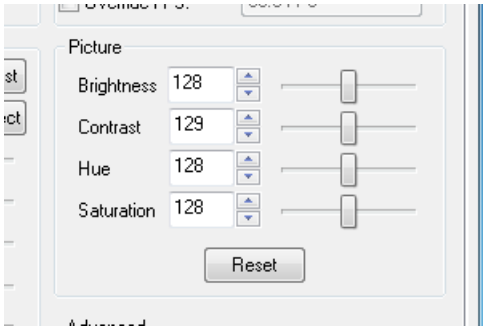
Note	You will need over 20 fps capture speed for acceptable quality of moving objects. Please lock 60 Hz input video to 30 fps (SRC/2) or 20 fps FPS (SRC/3) and 50 Hz input video to 25 fps (SRC/2).

You can have the UFG-05 output the captured bitmap flipped around vertically by selecting the **Flip Vert.** check-box. This means that the image is stored upside down. This is the default image for Windows® and some applications operate properly with this format. Please verify if your application accepts the state and leave it unchecked. Please note that *Flip Vert.* is only operational when *Override Resolution* is checked.



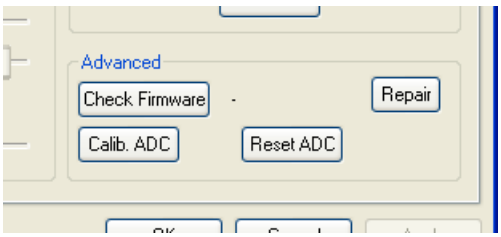
Adjusting Captured Colors

The *Picture* section contains controls for adjusting the color information. *Brightness, Contrast, Hue* and *Saturation* have unique values for all three input types. The values are stored and re-loaded when the corresponding input is selected. The *Reset* button sets the factory default values. In most cases these values give an optimum result.



Advanced Controls

The **Advanced** section contains controls for advanced features of the UFG-05 unit. The user might need the functions after the installation of the unit but not during the normal operation. Please use the features in this section with care. When done improperly, they may impair the correct operation of the UFG-05 unit.



Check firmware

You can check the firmware version loaded into the non-volatile memory of the unit by clicking **Check Firmware** button. The firmware version must match to the driver version used. Firmware Update process is described in the *Installation* section earlier in this manual.

Reset

Repair Resets the UFG-05 unit. Not needed in normal operation.

A/D Converter Calibration

The A/D converter of the Analog input can be calibrated by using the **Calib ADC** button. The calibration is done to adjust the variations of the integrated circuits. The A/D converter calibration is done during manufacturing of the UFG-05 unit and the user does not need normally to use this button.

In order to perform the calibration properly, the set-up needs to fulfill the following requirements:

- The test image source has to be calibrated
- The test image must contain large fully white and fully black areas.
- The test image must contain smooth horizontal transitions.
- You have to use a timing that is well detected and adjusted before color calibration
- You have to use RGB *Sub-Type* even if YPbPr will be used later

Note	A/D converter calibration is done during manufacturing and the user does not need to perform it with his video sources.

If one reason or other you believe that the A/D converter calibration is not correctly set and if a proper test image source is not available, please use the **Reset ADC** button. It will reset the calibration data to default values. The result will provide acceptable captured images but the variations in the integrated circuits will not be compensated.

5. USAGE

The driver software provided with the UFG-05 family frame grabbers is an AVStream WDM driver compatible with standard capturing applications supporting Microsoft® DirectShow®. The driver is built for Microsoft® Windows Vista and XP.

Previewing Video

You may preview the video captured by UFG-05 with applications like *Windows Media Encoder, VirtualDUB, AmCap, GraphEdit*, etc. The driver has been tested with all standard DirectShow renderers.

The UFG-05 appears as a single DirectShow Filter (UFG-05 Channel) under the group Video Capture Sources in GraphEdit

To gain best picture quality do not set 60 Hz for 50 Hz based signals

Use the *Override* settings in the FG properties dialog if you need a custom format. Some applications might need reconfiguration as this setting is applied when the graph is rebuilt.

The SRC, SRC/2, SRC/3, SRC/4 frame rate settings give the best picture quality because they give a *Frame Locked* stream. When you use them, rebuild the graph each time the source frame rate changes.

When capturing the PCI bus bandwidth might be the bottleneck of the system especially if you use a high performance PCI Express graphics card.

UFG-05 series frame grabbers are fully compatible with *Vista Aero*

Capturing Video

The UFG-05 driver stores the captured images only as 32-bit RGB bitmaps. In order to generate compressed stream formats a software tool with a compression codec is needed.

You can frame lock to every 2nd, 3rd or 4th frame of the original video input to save PCI bus bandwidth and ensure a smooth video stream output.

When capturing video, the CPU performance or the hard disk storage performance might be the bottleneck of the system.

Applications and Troubleshooting

You might experience some issues in the tested applications. Here are the procedures how to resolve them.

GraphEdit

In GraphEdit insert the filter of the device (usually UFG-05 Channel) to the graph. Right click on the single pin and choose render. Start the graph with the play button.

If you want to preview with a custom format, disconnect the graph by clicking on the arrow coming out of the UFG-05 filter and pressing the Del key. Right click on the filter and set the appropriate Override Resolution or Override FPS checkbox with the format. Press OK and reconnect the graph.

If the picture appears upside down follow the previous steps but try to check also the *Flip Vert.* checkbox

AmCap

AmCap is a sample capture application of Windows

If you want to capture to a different resolution than the default, open the *FG Properties* window, check *Override Resolution* and select the desired format. To apply this setting to the preview window open the *Video Capture Pin…* dialog and press Cancel.

If you use the *Override FPS* function in AmCap you cannot set the frame rate in the Capture/Set Frame rate menu.

If you experience issues with the AmCap.exe in Windows SDK (Vista Build 6000) please use the application from the previous releases of Windows Platform SDK

Windows Media Encoder

Windows Media Encoder is a standard reference application for DirectShow. There are no known issues with the use of UFG-05 with WME.

Please note that WME is very sensitive to CPU performance. When storing to *.wmv file format this might be the bottleneck

VirtualDUB

VirtualDUB is a freeware video capture software application originally written to capture Video for Windows sources. The recent versions are already compatible with DirectShow. The tested and proposed version is 1.6.16.

VirtualDUB normally cannot accept top-down RGB images which are default in UFG-05 for performance reasons. To avoid this open the menu **Video** > **Set Custom Format** and set the Use Custom Size fields to for example 640x480 instead of the default values.

Some VirtualDUB codecs have problems when using with UFG-05 output streams.

Performance

The achieved capture rate depends on several performance factors of the capturing PC and the frame grabber. Some remarks have been mentioned above when reviewing the applications. Some general rules apply to all SW.

PCI Bus

Each PCI bus type has its characteristic data transfer performance. The performance achieved with a PCI Express bus card is better than the one with a PCI bus. A 66 MHz PCI bus card will provide better performance than a 33 MHz card. A 4 lane PCI Express bus card will have an improved data transfer performance over a single lane bus card.

Note:	Please use a PCI Rev 2.2 (66 MHz) slot for *UFG-05 32* or *UFG-05 Dual64*, PCI-X (66 MHz) for *UFG-05 Dual64*, PCI Express 1.0 for *UFG-05 1E* and PCI Express 2.0 for *UFG-05 4S*. You can use either a 3.3 V or a 5 V slot

The PCI bus performance is typically the limiting factor when previewing captured video. This is especially true when using a modern display card connected with a 16 lane PCI Express bus.

Calculating the Requested Bandwidth

You can calculate the data bandwidth needed to capture certain resolution image with the requested frame rate.

The bandwidth can be calculated using the formula:

*W = ResX * ResY * FPS * 4 Bytes,*

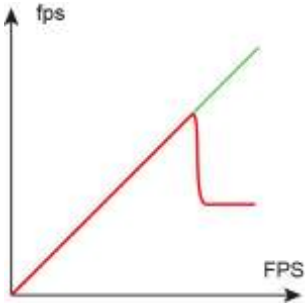
where *W* is the bandwidth, *ResX* is the captured horizontal resolution, *ResY* captured vertical resolution, *FPS* the captured frame rate (frame per second). For example a 1920 x 1080 signal with 20 fps needs a bandwidth of 1920*1080*20*4 = 158.2 MBytes/s.

Note:	Please note that if you are using the hardware scaling and frame rate reduction with UFG-05, you should calculate the bandwidth with the selected *Override Resolution* and *Override FPS* values instead of the resolution and frame rate of the input video.

Estimating the Bandwidth

You can estimate the current maximum bandwidth of a PC capturing setup by altering the capture parameters and at the same time monitoring the achieved capture performance.

Start with your requested resolution and a low frame rate. Step by step increase the frame rate. At a certain point the achieved frame rate will drop down to only half of the requested frame rate. This point is the current capture bandwidth of the system for that resolution. The following graph illustrates the situation.



The graph above shows the relation of the *Requested Frame Rate* (FPS) and the *Achieved Frame Rate* (fps). On a certain FPS level the achieved fps drops to half of the requested FPS and stays there. The FPS value jus below this point provides the optimum performance for the PC capturing setup.

The reason why the achieved fps drops to the half of the requested FPS is based on the way how the PCI bus data transfer occurs.

- During streaming, the application requests a new frame based on the R*equested Frame Rate FPS*. The pace is calculated from the PC real-time clock.
- Everything goes well provided that the whole frame data has been transferred from the frame grabber to the PC before the next request occurs.
- However if the R*equested Rate FPS* is too high, the bus is not ready and the transfer of the following frame is cancelled. A new frame is transferred only on the following request.
- At this point the user sees the A*chieved Frame Rate fps* halved.

Frame Locking

The achieved frame rate is not only dependent on the card to PC bus transfer speed. It is also dependent on the CPU performance, the memory bandwidth and the hard disk data rate specially when capturing non-compressed video.

Please prefer the Frame Locked operation. In this operation mode the hardware provides frames to the application only with a constant rate fixed to the input frame frequency. This enables that the performance variations caused by e.g. software compression will not affect the *Achieved Frame Rate fps*. The result will be a smoother video stream compared to a situation when the *fps* constantly changes.

Other Limitations

Please note that the data bandwidth of an ATA disk is only 40 MBytes/s. Please consider using SATA drives instead.

The CPU performance is a typical bottleneck when creating a compressed video stream. If Windows Media Encoder captures fewer frames than requested, please check the CPU utilization. If it is very high, you should reduce the requested frame rate. Memory bandwidth may also affect CPU utilization.

APPENDIX A. PRODUCT SPECIFICATION

Analog Video Input

Connector	15-pin Sub-D, 2 x DVI-I for UFG-05 Dual 64
Color Coding	RGB or YPbPr
Input Resolution Range	640 x 480 to 1920 x 1200
Horizontal Sync Range	45 Hz to 120 Hz Input locking to 50 Hz and 60 Hz
Pixel frequency Range	25 MHz to 165 MHz
Color Depth	8 bits per color
Sync Modes	Automatically detect RGBHV, RGsB, RGBC
Scan Modes	Progressive, interlaced
Video Modes	Auto-detects most progressive PC timings, various 1366 x 768 timings, etc. Auto-detects HDTV Timings up to 1080p60. Supports CVT timings

Digital TMDS Video Input

Connector	DVI-I (digital only), 2 x DVI-I for UFG-05 Dual 64
Color Coding	RGB or YCbCr
Input Resolution Range	640 x 480 to 1920 x 1200
Horizontal Sync Range	45 Hz to 120 Hz Input locking to 50 Hz and 60 Hz
Pixel Frequency Range	25 MHz to 160 MHz
Color Depth	8 bits per color component

S-Video and Composite Video Input

Connector	S-Video Connector
Supported standards	PAL, NTSC, SECAM

HW Features

PCI bus	Bus Master using shared interrupt UFG-05 32, UFG-05 Dual 32: 32-bit 66 MHz PCI (2.2) UFG-05 64: PCI-X 64 UFG-05 1E: PCI Express 1 lane (1.0) UFG-05 4S: PCI Express 4 lane (2.0) (8 lane physical)
System Memory Size	All models except UFG-05 4S, 4 GBytes maximum
Capture Quality	Hardware driven frame rate Capable to lock to input frequency (50 Hz, 60 Hz) Capability to get every 2nd, 3rd, 4th frames No busy wait. The capture and the control thread do not stall the CPU for significant times. Sync checking and notification. Stable image: flickering masked out Two independent channels in UFG-04 Dual 32 and UFG-04 Dual 64

Driver Properties

Operating Systems	Windows® 7 (64 and 32 bit), Vista (32 and 64 bit) and XP (32 bit)
SW Interface	64 and 32 bit AVStream drivers (x64, WOW64, X86) drivers with configuration dialog
Output Format	RGB32. Top down or vertically inverted
Power Management	Supports Power Management on XP, Vista and Win 7
User Functions	Allows setting manual timings. Adjustable Brightness, Contrast, Hue, Saturation separate for all three input types. Function to force default format change for applications that do not have advanced HD Stream Format Dialog. External firmware update capable
Compatibility	Tested with common applications as AmCap, Windows Media Encoder, Graphedit and VirtualDUB, VLC etc

Capture Speed

Resolution	UFG-05 4S	UFG-05 1E	UFG-05 32	UFG-05 Dual 32**)	UFG-05 Dual 64**)
1920 x 1200	60 fps	14 fps	11 fps	6 fps	16 fps
1920 x 1080	60 fps	15 fps	13 fps	7 fps	16 fps
1600 x 1200	60 fps	17 fps	14 fps	8 fps	16 fps
1400 x 1050	60 fps	22 fps	18 fps	10 fps	22 fps
1280 x 1024	60 fps	25 fps	21 fps	11 fps	24 fps
1280 x 720	60 fps	36 fps	29 fps	15 fps	35 fps
1024 x 768	60 fps	42 fps	35 fps	14 fps	41 fps
800 x 600	60 fps	60 fps	57 fps	29 fps	60 fps
640 x 480	60 fps	60 fps	60 fps	34 fps	60 fps
Max Data Rate	650 MBytes/s	133 MBytes/s	110 MBytes/s	2 x 55 MBytes/s	2 x 130 MBytes/s

*) The performance record is based on tests in the following PC environment:
Intel® Q6600 Quad Core 2.4 GHz, 4 GB RAM, Windows® XP Sp3

**) Performance per channel. The two channels are independent.

General

Module Size	UFG-05 4S: 106 x 155 mm UFG-05 1E: 106 x 160 mm UFG-05 32: 106 x 174 mm UFG-05 Dual 64: 106 x 250 mm UFG-05 Dual 32: 106 x 250 mm
Power Consumption	UFG-05 4S: 1 W max on +3.3 V; 5 W max on +12.0 V Other models: 6 W (9 W Dual 64) max on +3.3 V; 1 W max on +12.0 V

APPENDIX B. SUPPORTED VIDEO MODES

Resolution (Pixels)	Vertical Frequency (Hz)
640x480	60, 72, 75, 85, 100, 120, 135
640x350	85
640x400	60, 75, 100
700x525	60
720x400	70, 85
720x483	60
800x600	50, 56, 60, 72, 74, 85, 100
768x576	50
848x480	60, 70
1024x640	60
1024x384	87
1024x768	50, 55, 60, 70, 75, 85, 100, 120, 135
1152x864	60, 75, 85, 100
1280x720	50, 60
1280x768	70
1280x800	60, 70, 75, 85
1280x960	60, 75, 85
1280x1024	45, 50, 51, 55, 60, 65, 70, 75, 85
1360x768	60
1400x1050	60, 70
1440x900	60
1600x1000	60
1600x1024	60
1600x1200	45, 50, 55, 60
1680x1050	60
1920x1080	50, 55, 60
1920x540	60
1920x1200	50, 60

DECLARATION OF CONFORMITY

CE

We declare under our sole responsibility that the following products:

Unigraf UFG-05 family

to which this declaration relates, is in conformity with the protection requirements of Council Directive: 89/336/EEC as emendated by 92/31/EEC and 93/68/EEC on the approximation of the laws of the Member States relating to Electromagnetic Compatibility.

The following standards are applied to the listed products:

EN 50081-1	Electromagnetic Compatibility - General Emission Standard, Part 1; Residential, commercial and light industry environment
EN 50082-2	Electromagnetic Compatibility - General Immunity Standard, Part 2;Industrial Environment

Products are developed, tested and provided under an extensive Quality Management System.

The authorized signatory to this declaration, on behalf of the manufacturer, and the Responsible Person based within the EU, is identified below.

UNIGRAF Oy
Ruukintie 3
FIN-02330 Espoo
Finland

Kari Liinaharja
Quality Manager

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